

## Appendix B Information Sources for Ecological Risk Assessment

### B.1 Procedural and Guidance Documents

Canada Council of Ministers of the Environment (CCME). 1995. *Protocol for the Derivation of Canada Sediment Quality Guidelines for the Protection of Aquatic Life*. Guidelines Division, Evaluation and Interpretation Branch, Environment Canada, Ottawa, Canada. Report CCME EPC-98E. March.

Department of Energy (DOE). 1991. *Natural Resource Trusteeship and Ecological Evaluation for Environmental Restoration at Department of Energy Facilities*. DOE/EH-0192.

Department of Energy (DOE). 1993. *Policy Framework and Implementation Plan for Using Ecological Risk Assessment at DOE Facilities*. DOE/RL/01830-H16.

Department of Energy (DOE). 1993. *Remedial Investigation/Feasibility Study (RI/FS) Process and Techniques Guidance*. 3/93.

Department of Energy (DOE). 1994. *Ecological Risk Assessment Guidance for Preparation of Remedial Investigation/Feasibility Study Work Plans*. DOE/EH-0338.

Department of the Navy. 1994. *Environmental and Natural Resources Program Manual*. OPNAVINST 5090.1B. Washington, D.C. 11/1/94.

DeSesso, J. M., and Price, F. T. 1990. *General Guidance for Ecological Risk Assessment at Air Force Installations*. Human Systems Division IRP Program Office. 12 pp. and Appendix: Terrestrial Toxicity Test Methods (3 pp.)

Environment Canada. 1994. *A Framework for Ecological Risk Assessment at Contaminated Sites in Canada. Review and Recommendations*. Ecosystem Conservation Directorate, Evaluation and Interpretation Branch, Ottawa, Ontario. Scientific Series No. 199.

Proposed framework for conduct of ERAs at contaminated sites in Canada. This proposed framework is similar to others developed for various regulatory programs.

EPA. 1984. *Policy and Program Requirements to Implement the Mandatory Quality Assurance Program*. EPA Order 5360.1.

EPA. 1989. *Risk Assessment Guidance for Superfund - Volume II: Environmental Evaluation Manual (RAGS II)*. Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/001, 3/89.

The guidance consists of two parts: (1) a guidance manual that established a general framework for understanding the ecological principles of a Superfund ERA and discusses the performance of the assessment, and (2) a compendium method handbook, "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference."

EPA. 1990. *Water Quality Standards for Wetlands - National Guidance*. Office of Water. EPA 440/2-90-011.

EPA. 1990. *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*. Office of Emergency and Remedial Response. EPA/540/G-90/007.

EPA. 1992. *Framework for Ecological Risk Assessment (Framework)*. Risk Assessment Forum. EPA/630/R92/001,2/92.

Presents the guiding principles and structure for the conduct of an ERA.

EPA. 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term*. Intermittent Bulletin Publication 9285.7-081. Office of Solid Waste and Emergency Response.

Although written as a supplement to RAGS I, this bulletin is also applicable to ecological risk assessment as it describes the method and reasons for calculating the 95% UCL.

EPA. 1992. *Guidelines for Exposure Assessment*. 57 FR 22888-22938.

Although these guidelines are written for human health assessment, various principles presented are relevant to ecological risk exposure assessments.

EPA. 1993. *Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria*. Memorandum from Office of Water to Water Management Division Directors. 10/1/93.

EPA. 1993. *Implementation of Metals Criteria*. Memorandum from Office of Water to Water Management Division Directors. 4/1/93.

EPA. 1993. *Great Lakes Water Quality Initiative Criteria Documents for the Protection of Wildlife - DDT, Mercury, 2,3,7,8-TCDD, and PCBs*. Office of Water. EPA/822/R-93/007, 4/93.

EPA. 1993. *Wildlife Criteria Portions of the Proposed Water Quality Guidance for the Great Lakes System*. Office of Water. EPA/822/R-93/006, 7/93.

EPA. 1993. *Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process*. Interim Final. Quality Assurance Management Staff. EPA QA/G-4.

EPA. 1994. *Interim Guidance on Determination and Use of Water-Effect Ratios (WERs) for Metals*. EPA 823/B/94/001. February.

Presents an effluent-specific approach for calculating a total recoverable metal permit limit from the dissolved metal criterion. Appendix D explains the relationship between WERs for dissolved criteria and WERs for total recoverable criteria.

EPA. 1994. *Equilibrium Approach to Predicting Metal Bioavailability in Sediments and the Derivation of Sediment Quality Criteria for Metals*. Volume I Briefing report to the EPA Science Advisory Board. Office of Water and Office of Research and Development. December.

This document is a compilation of data and analyses from scientific investigation into the bioavailability of metals in sediments to benthic organisms with the intent of proposing an approach to assessing metals contamination of sediments for the protection of benthic organisms.

EPA. 1994. *Water Quality Standards Handbook*. Second Edition. Water Quality Standards Branch. Office of Water. August. EPA-823-B-94-005A.

An annotated list of the major guidance and policy documents on the water quality standards program issued since 1983 is included in the Introduction. Material added to the Second Edition by periodic updates since 1993 is summarized in the Appendix.

The handbook includes chapters on general provisions (40 CFR 131 - Subpart A), designation of uses (40 CFR 131.10), water quality criteria (40 CFR 131.11), antidegradation (40 CFR 131.12), general policies (40 CFR 131.13), procedures for review and revision of water quality standards (40 CFR 131 - Subpart C), and the water quality-based approach to pollution control.

EPA. 1995. *Study of Federal Water Quality Criteria for Metals; Water Quality Standards: States Compliance-Revision of Metals Criteria*, Interim Final Rule. 40 CFR part 131. Federal Register Vol. 60 (May 4) No. 86, p. 22228.

This interim final rule establishes metals criteria that are protective of aquatic life and approximate, better than the 1992 criteria, the biologically available fraction of waterborne metals to aquatic organisms.

EPA. 1995. *Guidance for Risk Characterization*. Science Policy Council. 2/95. 29 pp.

This guidance contains principles for developing and describing EPA risk assessments, with a particular emphasis on human health risk characterization. This guidance does not specifically address ecological risk assessment, although it does present guiding principles for human health risk assessments that are equally applicable to ecological risk assessments.

EPA. 1995. *Policy for Risk Characterization: Memorandum from Carol M. Browner, EPA Administrator*. 3/21/95.

This policy statement and associated guidance for risk characterization (EPA, Science Policy Council, 1995) are designed to ensure that critical information from each stage of a risk assessment is used in forming conclusion about risk and that this information is appropriately communicated from risk assessors to risk managers. This policy provides a basis for greater clarity, transparency, reasonableness, and consistency in risk assessments across Agency programs.

EPA. 1995. *Final Water Quality Guidance for the Great Lakes System*. Federal Register, Volume 60, No. 56. 3/23/95.

Water Quality Criteria for 29 pollutants to protect aquatic life, wildlife and human health and detailed methodologies to develop criteria for additional pollutants. Locations for obtaining supporting documents are listed. EPA is also making a number of documents available in electronic format at no incremental cost to users of the Internet (see Great Lakes Information Network (GLIN)).

EPA. *BTAG Forum*. Office of Solid Waste and Emergency Response (OSWER).

BTAG Forum is a bulletin series published primarily to foster communication among biological/ecological technical assistance groups (BTAGs/ETAGs) and to assist EPA site managers in designing, managing, and reviewing ecological assessments of Superfund sites.

EPA. *ECO Updates*. Office of Solid Waste and Emergency Response (OSWER), Hazardous Site Evaluation. Eco Update is a bulletin series on ecological risk assessment of Superfund sites. These bulletins serve as supplements to Risk Assessment Guidance for Superfund, Volume II: Environmental Evaluation Manual (EPA/540-1-89/001).

*The Role of Natural Resource Trustee in the Superfund Process*. Vol. 1, No. 3. 1992. Publ. 9345.0-051.

*Developing a Work Scope for Ecological Assessments*. Vol. 1, No. 4. May 1992. Publ. 9345.0-051.

*Using Toxicity Tests in Ecological Risk Assessment*. Vol. 2, No. 1. September 1994.

*Catalogue of Standard Toxicity Tests for Ecological Risk Assessment*. Vol. 2, No. 2. September 1994.

*Field Studies for Ecological Risk Assessment*. Vol. 2, No. 3. September 1994.

*Selecting and Using Reference Information in Superfund Ecological Risk Assessments*. Vol. 2, No. 4. September 1994.

#### EPA. OSWER DIRECTIVES

*Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*. 1991. OSWER Directive 9355.0-30, 4/22/91 (current vs. future land use).

*Guidance on Risk Characterization for Risk Managers and Risk Assessors*. 1992. OSWER (no number), 5/26/92. Addresses risk assessment vs. risk management.

*New Policy on Performance of Risk Assessments during Remedial Investigation/Feasibility Studies (RI/FSs) Conducted by Potentially Responsible Parties (PRPs)*. 1993. Directive No. 9835.15b.

*Role of the Ecological Risk Assessment in the Baseline Risk Assessment*. Memorandum from Elliott P. Laws, Assistant Administrator. 1994. OSWER Dir. No. 9285.7-17.

Persaud, D., Jagumagi, R., and Hayton, A. 1992. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. Water Resources Branch, Ontario Ministry of the Environment. ISBN 0-7729-9248-7.

Contains protocol for setting sediment quality guidelines and application of the sediment quality guidelines for freshwater systems.

USACE. 1991. *Commander's Guide to Environmental Management*. Author: J.B. Pringle. Prepared for USATHAMA, Aberdeen Proving Ground, MD. CETHA-EC-TR-91036.

U.S. Army Research, Development and Engineering Center (USAERDEC). 1994. *Procedural Guidelines for Ecological Risk Assessment at U.S. Army Sites*. Wentzel, R.S., T.W. La Point, M. Simini, R.T. Checkai, D. Ludwig, and L. Brewer. 2 Volumes.

Volume 1 is designed to enhance an understanding of the ecological risk assessment requirements under CERCLA. Using a three-tiered analysis process, emphasis in this document is placed on the ecological effects-toxicity test based approach to ERAS. Volume 2 contains information on more than 100 environmental models and test methods.

U.S. Air Force (USAF). 1990. *General Guidance for Ecological Risk Assessment at Air Force Installations*. Prepared for the Human System Division IRP Program Office at Brooks AFB, TX.

Document provides an overview of ERA fundamentals and guidance for the conduct of an ERA. Guidance is provided for assessing the terrestrial, freshwater, and marine habitats.

## **B.2 Methods Documents and Technical Documents**

Barnthouse, L. W., Suter, G. W.; Bartell, S. M., et al. 1986. *User's Manual for Ecological Risk Assessment*. ORNL Oak Ridge, TN: Environmental Sciences Div. Publ. No. 2679.

U.S. Department of the Interior (DOI). 1991. *Plant Toxicity Testing With Sediment and Marsh Soils*. Authors G. E. Walsh. Technical Report NPS/NRWRD/NRTR-91/03.

EPA. 1978. *Quality Assurance Guidelines for Biological Testing: Environmental Monitoring Series*. Environmental Monitoring and Support Laboratory, Office of Research and Development, Las Vegas, NV. EPA-600/4-78-043.

EPA. 1986. *User's Manual for Ecological Risk Assessment*. Barnthouse, L. W., G. W. Suter, S. M. Bartell, J. J. Beauchamp, R. H. Gardener, E. Linder, R. V. O'Neill, and A. E. Rosen. Environmental Sciences Division. Publication No. 2679, ORNL-6251.

EPA. 1986. *Hazard Evaluation Division, Standard Evaluation Procedure, Ecological Risk Assessment*. Office of Pesticide Programs. EPA/540/9-85-001, 6/86.

EPA. 1986. *Review of Ecological Risk Assessment Methods*. EPA Office of Policy, Planning, and Evaluation, 11/86.

EPA. 1988. *Recommendations for and Documentation of Biological Values For Use in Risk Assessment*. Environmental Criteria and Assessment Office, Office of Research and Development. EPA/600/6-87/008, 2/88.

This document consists of an extensive compilation of values gleaned from the published literature sources for lifespan, body weight, food consumption, water consumption, and inhalation volumes for a wide range of predominantly mammalian species.

EPA. 1988. *Estimating Toxicity of Industrial Chemicals to Aquatic Organisms Using Structure Activity Relationships*. Office of Toxic Substances. EPA-560-6-88-001.

EPA. 1989. *Interim Procedures for Estimating Risks Associated with Exposures to Mixtures of Chlorinated Dibenzo-p-dioxins and Dibenzofurans (CDDs and CDFs). Update*. Risk Assessment Forum. EPA/625/3-89/016. March.

EPA. 1989. *Ecological Risk Assessment Methods: A Review and Evaluation of Past Practices in the Superfund and RCRA Programs*. Office of Policy, Planning, and Evaluation. EPA/230/03-89/044, 6/89.

EPA. 1989 to present. *Contaminated Sediment News*. Office of Water. EPA-823-N92-001.

EPA. 1989. *Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference Document*. Office of Research and Development. EPA/600/3-89/013. 3/89.

EPA. 1989. *Guidance Manual: Bedded Sediment Bioaccumulation Tests*. ERN-L, Pacific Ecosystems Branch, Bioaccumulation Team, Newport, OR. EPA/600/X-89/302; ERLN-N111.

EPA. 1991. *Assessment and Control of Bioconcentratable Contaminants in Surface Water*. Office of Water/Office of Research and Development. March.

EPA. 1991. *Evaluation of Dredged Material Proposed for Ocean Dumping*. Dept. of the Army, USACE. EPA/503/B-92/001.

EPA. 1992. *Sediment Classification Methods Compendium*. Office of Water. EPA-823-R-92-066. 3/92.

Includes chapters on Quality Assurance/Quality Control, Sampling, and Analytical Considerations; Bulk and Spiked-Sediment Toxicity Test Approaches: Tissue Residue Approach: Interstitial Water Toxicity Identification Evaluation Approach: Equilibrium Partitioning Approach, Sediment Quality Triad Approach, Apparent Effects Threshold Approach; Benthic Community Structure Assessments.

EPA. 1992. *Ecological Techniques for the Assessment of Terrestrial Superfund Sites*. Authors: G. Linder, E. Ingham, C. J. Brandt, and G. Henderson. Environmental Research Laboratory, Corvallis, OR. NTIS: PB93-1000865; EPA/600/R-92/183. 3/92. Also titled: Evaluation of Terrestrial Ecological Indicators at Superfund Sites.

EPA. 1992. Fish Field and Laboratory Methods for Measuring Biological Integrity of Surface Water. Office of Research and Development. EPA/600/R-92/111.

Compendium of plant and animal test methods used for the assessment of soil and sediment contamination. Methods which assess soils directly are emphasized here but additional methods applicable to wetlands soils or sediments have also been included to complement those methods readily available for aquatic and sediment toxicity assessment. Tabular guides to the selection of test methods applicable to various habitats and toxicity endpoints are summarized to help potential users select the most appropriate biological assessment tool for the site under consideration.

EPA. 1992. *Higher Plant Accumulation of Organic Pollutants From Soils*. Risk Reduction Engineering Laboratory, Office of Research and Development, Cincinnati, OH. EPA/600/R-92/138.

The purpose of this work was to determine the effect of higher plants on sites polluted by organic chemicals and to discuss the potential of using plants as an in situ cleanup treatment. This work is based primarily on literature review but also includes greenhouse experiments and field testwork.

EPA. 1993. *Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin Risks to Aquatic Life and Associated Wildlife*. Office of Research and Development, Washington, DC. EPA/600/R-93/055.

This report provides an initial base of information and analyses that EPA is planning to use for assessing risks of TCDD to aquatic life and wildlife. The analyses presented specifically address the direct toxic effects of TCDD to aquatic life and wildlife based on uptake from aquatic prey, sediment, and surface water.

EPA. 1993. *Wildlife Exposure Factors Handbook*. Office of Research and Development. EPA/600/R-93/187a&b,12/93.

Document summarizes literature values for exposure factors for 34 species of birds, mammals, amphibians, and reptiles. Includes chapter on allometric equation that can be used to estimate some of the exposure factors when data are lacking. To obtain a copy, call the Center for Environmental Research Information (CERI) at 513-569-7562.

EPA. 1993. *Superfund Program Checklist for Ecological Assessment/Sampling*. 1/93.

This checklist provides guidance on making observations during an ecological assessment, and is a screening tool for preliminary site evaluation. The checklist is not intended to be used for limited actions nor for purely industrial setting with no discharges, but may be useful in planning more extensive site investigations.

EPA. 1993. *Sediment Quality Criteria for the Protection of Benthic Organisms*. 59 FR 2652. The five proposed sediment criteria documents include Acenaphthene (EPA-822-R-93-013); Dieldrin (EPA-822-R-93-015); Endrin (EPA-822-R-93-016); Fluoranthene (EPA-822-R-93-012); and Phenanthrene (EPA-822-R-93-014).

To make the task easier for calculating sediment criteria, EPA has prepared Lotus and Excel spreadsheets with organic carbon levels (dry weight or %), fresh and marine sediment criteria values, and confidence limits that will be automatically calculated for the five draft criteria compounds. Spreadsheets are located on the Nonpoint Source Program electronic bulletin board (301)589-0205. EPA employees or contractors can download file (SQCCALC.ZIP). Final chronic values and  $K_{ow}$ s may be slightly different from those contained in current draft criteria documents.

EPA. 1993. *Technical Basis for Deriving Sediment Quality Criteria for Nonionic Organic Contaminants for the Protection of Benthic Organisms by Using Equilibrium Partitioning*. Washington, D.C. Office of Water. EPA/822/R-93/001.

EPA. 1994. *Ecological Risk Assessment Issue Papers*. Risk Assessment Forum. Office of Research and Development, Washington, DC. EPA/630/R-94/009.

EPA's issue papers and case studies are intended to provide scientific arguments for the appropriate use of ecological concepts at varying levels of ecological organization. The issue papers were prepared to provide a bridge between the skeletal structure provided by the Framework Report and the more fully developed concepts needed for Agency-wide risk assessment guidelines. Document presents issue papers on (1) Defining the Significance of Ecological Change, (2) Societal and Ecological Values, (3) Criteria for Determining Ecological Significance,

- (4) The Ecological Significance Framework, and
- (5) Ecological Significance Inputs to Decision Making.

EPA. 1994. *Peer Review Workshop Report on Ecological Risk Assessment Issue Papers*. Office of Research and Development. Washington, D.C. EPA/630/R-94/008.

EPA. 1994. *Representative Sampling Guidance Document*. Volume 3; Ecological. Washington, DC Office of Emergency and Remedial Response.

EPA. 1994. *EPA's Contaminated Sediment Management Strategy*. Washington, D.C.

Strategy describes the cross-program policy framework in which EPA intends to promote consideration and reduction of ecological and human health risks posed by sediment contamination. Goals of the strategy are: (1) to develop consistent methodologies for assessing contaminated sediments; (2) to prevent ongoing contamination of sediments that may cause unacceptable ecological or human health risks; (3) to clean up existing sediment contamination that causes significant effects on human health or the environment; and (4) to ensure that sediment dredging and the disposal of dredged material continue to be managed in an environmentally sound manner.

Food and Drug Administration (FDA). 1993. *Guidance Documents for Metals in Shellfish: Arsenic, Chromium, Cadmium, Lead, and Nickel* (5 volumes). Center for Food Safety and Applied Nutrition, Washington, DC.

The references in the back of these documents are also quite useful for ecological risk assessments for coastal and marine environments. Also, FDA's seafood list (ISBN 0-16-042999-4) identifies scientific, common, and vernacular names for the seafood.

Layton, D., Mallon, B., Mitchell, W., Hall, L., et al. 1987. *Conventional Weapons Demilitarization: A Health and Environmental Effects Data Base Assessment*. Final Report, Phase II for Lawrence Livermore National Laboratory and U.S. Army Medical Research and Development Laboratory, Ft. Detrick, MD. December. AD-A220-588; UCRL - 21109.

To support studies of environmental risks and byproducts, this report provides data on factors that influence transport and fate of explosives and co-contaminants in environmental media (e.g., soils, water). Information on dose-response relationships for various toxic effects in laboratory animals is evaluated. Toxic

effects on plants and aquatic species are also addressed.

Long, E. R., and Morgan, L. G. 1990. *The Potential for Biological Effects of Sediment Sorbed Contaminants Tested in the National Status and Trends Program*. NOAA (Seattle, Washington) Technical Memorandum NOS OMA 52.

NOAA's screening levels for chemical concentrations in marine sediments, based on studies at multiple sites. The screening levels, known as "effects range-low" (ER-Ls) and "effects range-median (ER-Ms), represent the 10th and 50th percentile, respectively, of the chemical mixture concentration at which effects were observed."

Long, E. R., MacDonald, D. D., Smith, S. L., and Calder, F. D. 1995. *Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments*. Environmental Management, Vol. 19, No.1, pp. 81-97.

Paper presents approach and guidelines for use in sediment quality assessments. This method is being used as a basis for developing National sediment quality guidelines for Canada and informal, sediment quality guidelines for Florida. While these methods and guidelines presented in this report do not necessarily represent NOAA or Florida policy, they are commonly used as screening criteria for aquatic systems.

MacDonald, D. D. 1994. *Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Vol. II: Application of the Sediment Quality Assessment Guidelines. Vol. III: Supporting Documentation: Biological Effects Database for Sediments. Vol. IV: Supporting Documentation: Regional Biological Effects Database for Sediments*. Prepared for Florida Department of Environmental Protection. Tallahassee. FL. November.

MacDonald, D., Matta, K., Field, L., Cairncross, C., and Munn, M. 1992. *The Coastal Resource Coordinator's Bioassessment Manual*. NOAA/Hazardous Material Response and Assessment Division, Seattle, WA.

This manual was designed for use by NOAA's Coastal Resource Coordinators as an introduction to and a general guide for using bioassessment techniques for evaluating conditions at hazardous waste sites and is a ready reference to evaluate proposed ecological work plans for those sites. Chapters

include: Role of Bioassessment in the Remedial Process; Toxicity Tests: Bioaccumulation; Biomarkers; Benthic Community Studies; Study Design and Statistical Analysis: Recommended Bioassay Protocols for Soil, Water Column and Sediments.

National Research Council (NRC). 1986. *Ecological Knowledge and Environmental Problem-Solving: Concepts and Case Studies*. National Academy Press, Washington, D.C.

Oak Ridge National Laboratory (ORNL). 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*. Authors: Baes, C. F., R. D. Sharp, A. L. Sjoreen, and R. W. Shor. Prepared for Dept. of Energy. ORNL-5786. 150 p.

Oak Ridge National Laboratory (ORNL). 1990. *Integrating NEPA and CERCLA Requirements During Responses at DOE Facilities*. Authors: M. B. Levine, E. Smith, F. Sharples, G. Eddleman. ORNL/TM-11564.

Oak Ridge National Laboratory (ORNL). 1994. *Toxicological Benchmarks*. Includes the following reports:

Suter, G. W., and Mabrey, J. B. 1994 (revision). *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota*. ORNL Environmental Restoration Program ES/ER/TM-96/R1.

Opresko, D. M., Sample, B. E., and Suter, G. W. 1994 (revision). *Toxicological Benchmarks for Wildlife*. ORNL Environmental Restoration Program ES/ER/TM-886/R1.

Will, M. E., and Suter II, G. W. 1994 (revision). *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants*. ORNL Environmental Restoration Program ES/ER/TN-85/R1.

Will, M. E., and Suter II, G. W. 1994 (revision). *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes*. ORNL Environmental Restoration Program ES/ER/TM-126.

Office of Health and Environmental Assessment (OHEA). no date. *Exposure Models Library with the Integrated Model Evaluation System (EML/IMES)*.

U.S. Fish and Wildlife Service (USFWS). 1979. *Classification of Wetlands and Deepwater Habitats of the United States Biological Services Program*. Authors: L. M. Cowardin, V. Carter, F. C. Galet, and E. T. LaRoe. FWS/OBS-79/31. December.

U.S. Fish and Wildlife Service (USFWS). 1985 to 1994. *Contaminant Hazard Review Series*. Series by R. Eisler, USFWS, Dept. of Interior.

Between 1985 and 1989 USFWS published the Contaminant Review Series by Eisler for a number of chemicals of ecological concern. These documents summarize the chemical's environmental chemistry, background concentrations in biological and nonbiological samples, and lethal and sublethal effects in terrestrial plants, invertebrates, aquatic biota, birds, and mammals. The documents also propose health-based criteria or doses for these species. In the Biological Report 90(2), USFWS also summarized data on soil toxicity for screening assessments of terrestrial systems (Evaluating Soil Contamination, Beyer 19%). Copies of individual reviews may be obtained from FWS, 1849 C Street N.W., Mail Stop 130-ARLSQ, Washington, DC 20240, or through the National Technical Information Service.

U.S. Fish and Wildlife Service (USFWS). 1987. *Guidance on Use of Habitat Evaluation Procedures, and Suitability Index Models for CERCLA Application*. Type B Technical Information Document. PB88-100151.

U.S. Fish and Wildlife Service (USFWS). 1989. *Annotated Bibliography of Ecological Cumulative Impacts Assessment*. Authors: S.C. Williamson and K. Hamilton. National Biological Ecology Research Center, Ft. Collins, CO. Biological Report 89(11).

Water Environmental Research Foundation. 1994. *Methodology for Aquatic Ecological Risk Assessment*. Draft Final Report. Prepared for Water Environment Research Foundation, Alexandria, VA.

Document is intended for use by members of the regulated or regulatory communities who need to estimate the effects of toxic chemicals on aquatic communities from (1) new or nonpoint sources of chemicals, (2) improved wastewater treatment, (3) increase/decrease in discharge from an existing wastewater treatment facility, (4) more/less stringent numerical water quality standard, (5) hazardous waste site cleanup or remediation.

### B.3 Additional EPA Documents

EPA. 1983. *Testing of Environmental Effects Under the Toxic Substances Control Act*. Environmental Effects Branch, Office of Toxic Substances.

EPA. 1987. *Risk Assessment Guidelines of 1986*. EPA/600/8-87/045, 8/87 (principally human health).

EPA. 1988. *State Water Quality Standards Summaries*. Office of Water. EPA 440/5-88-031, 9/88.

EPA. 1988. *Superfund Exposure Assessment Manual*. EPA/540/1-88/001,4/88.

EPA. 1989. *Screening Study for Wildlife Criteria Development*. Office of Water/Office of Water Regulations and Standards. September.

EPA. 1989. *Summary of Ecological Risks, Assessment Methods, and Risk Management Decisions in Superfund and RCRA*. Office of Policy Analysis, Planning and Evaluation. EPA-230-03-89-046.

EPA. 1990. *National Oil and Hazardous Substances Pollution Contingency Plan*. Final Rule 55 FR 8660, 3/8/90.

EPA. 1991. *Peer Review Workshop Report on a Framework for Ecological Risk Assessment*. EPA/625/3091/022.

EPA. 1991. *Technical Support Document for Water Quality-Based Toxic Control*. Office of Water. EPA/505/2-90-001. PB91-127415. March.

EPA. 1991. *Summary Report on Issues in Ecological Risk Assessment*. Risk Assessment Forum. EPA/625/3-91/018.

EPA. 1991. *Hazard Profiles - Selected Heavy Metals*. Ecological Effects Branch, Office of Toxic Substances. August 1991.

EPA. 1992. *Guidelines for Exposure Assessment*. Federal Register. 57: 22888-22938 (May 29).

EPA. 1992. *Peer Review Workshop Report on a Framework for Ecological Risk Assessments*. Risk Assessment Forum. EPA/625/3-91/022.

EPA. 1992. *Report on the Ecological Risk Assessment Guidelines Strategic Planning Workshop*. EPA/630/R-92/002.

EPA. 1992. *Interim Guidance on Interpretation and Implementation of Aquatic Life Criteria for Metals*. Office of Science and Technology, Health and Ecological Criteria Division. 5/92.

EPA. 1993. *A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective*. 1993. Risk Assessment Forum. EPA/630/R-92/005, 5/93.

EPA. 1993. *Data Quality Objectives Process for Superfund*. Office of Emergency and Remedial Response, Washington, DC. EPA/540/R-93/078.

EPA. 1994. *A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective*. Risk Assessment Forum. EPA/630/R-94/003.

Presents five case studies which address a broader understanding of the ERA process.

EPA. 1994. *Workshop on the Use of Available Data and Methods for Assessing the Ecological Risks of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin to Aquatic Life and Associated Wildlife*. Office of Research and Development. Washington, DC. EPA/630/ZR-94/002.

### B.4 State and Regional EPA Guidance Documents

#### California

California Dept. of Toxic Substances Control (California EPA). *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities*. 1994. 2 Parts. Part A: Overview. Part B: Scoping Assessment.

#### Florida

Approach to the Assessment of Sediment Quality in the Florida Coastal Waters. Florida Dept. of Environmental Protection.

#### Massachusetts

Massachusetts Department of Environmental Protection. 1994. *Environmental Risk Characterization Guidance*. January (Draft).



#### New York

New York Department of Environmental Conservation (NYDEC). 1991. *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites*. June.

NYDEC. 1992. *Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels*.

#### Pennsylvania

Pennsylvania Dept. of Environmental Resources (1991). *Risk Assessment Guidelines for Facilities Burning Hazardous Waste* (Draft). Includes ERA guidelines.

#### Region III - EPA

*Interim Ecological Risk Assessment Guidelines*. July 27, 1994. Prepared by Robert S. Davis, Biologist, Technical Support Section, Superfund Program Branch, HWMD, Philadelphia, PA. 12 pp. Includes attachments on Data Presentation and Basic Surface Water and Sediment Parameters.

*Chemical Concentration Data Near the Detection Limit*. November 1991. Region III Technical Guidance Manual. EPA/903/8-91/001.

Hazard Evaluation Handbook: A Guide to Removal Actions. Third Edition. Guide for risk-based removal activities.

#### Region IV - EPA

*New Interim Region IV Guidance*. February 1992. Primarily for human health, document provides adopted toxicity equivalency factors (TEFs) for PAHs; sample RME calculation. 9 pp.

*Rapid Bioassessment Protocols for the Evaluation of Terrestrial Indicators*. (Draft).

#### Region V - EPA

*Regional Guidance for Conducting Ecological Assessments*. June 25, 1992. Final version. 9 pp. USEPA, Region V, Chicago, IL.

#### Region VI - EPA

*Regional Guidance for Conducting Ecological Assessments*. 1991.

*Region 6 Standardized Ecological Risk Format*. 1992. 2 pp.

#### Region VIII - EPA

Region 8 Superfund Technical Guidance. 1994. *Calculating the Concentration Term for Risk Assessment: Use of One "C" Term to Estimate a Lower Average and an Upper RME Risk Range*. No. RA-02: Concentration Term.

This regional guidance is intended to help clarify the proper calculation and use of the Concentration Term for Super-fund risk assessments. the correct determination and use of this term is essential to comply with EPA policy (H. Habicht. Feb. 1992) that both average and RME risk estimates be provided in risk assessments. These two risk estimates are based upon one average Concentration Term, which is currently defined as the 95% UCL of the mean.

#### Region X - EPA

Region 10 is expected to publish ecological risk guidance by November 1995.

### B.5 Professional Organizations

American Society for Testing and Materials (ASTM). ASTM is a not-for-profit organization which provides a forum for producers, users, ultimate consumers, and those having a general interest (representatives of government and academia) to meet on common ground and write standards for materials, products, systems, and services. ASTM continues to develop standards relevant to the ecological risk assessment practice. Contact ASTM, 1916 Race Street, Philadelphia, PA 19103, tel. 215-299-5454.

Ecological Society of America (ESA). ESA provides for the certification of professional ecologists based on specified minimum standards of education and credentials. The primary objective of the ESA Certification Program is to provide public and private clients and employees more positive access to professional advice in matters

concerning ecological relationships and resources. Contact ESA, Duncan Patten (business manager), tel. 602-965-3000.

Society for Environmental Toxicology and Chemistry (SETAC). SETAC is a nonprofit, professional society established to provide a forum for individuals and institutions engaged in the study of environmental problems, management and regulation of natural resources, education, research and development, and manufacturing and distribution. Contact SETAC, 1010 North 12th Ave., Pensacola, FL 32501, tel. 904469-1500.

Publications Smithsonian Press. The Smithsonian Institute offers publications on a variety of topics relevant to ecological risk assessment, e.g., amphibian sampling guidance, etc., tel. 202-287-3738 (see Internet).

## B.6 Recent Books

Calabrese, E. J., and Baldwin, L. A. 1993. *Performing Ecological Risk Assessments*. Lewis Publishers, Boca Raton, FL. 288 pp.

Dallinger, R., and Rainbow, P. S. 1993. *Ecotoxicology of Metals in Invertebrates*. CRC Press, Lewis Publishers, Boca Raton, FL.

Forbes, V. E., and Forbes, T. L. 1994. *Ecotoxicology in Theory and Practice*. Chapman and Hall, London, England. 247 pp.

Hoffman, D. J. 1994. *Handbook of Ecotoxicology*. CRC Press, Lewis Publishers, Boca Raton, FL.

Kendall, R. J., and Lather, T. E., Jr. 1994. *Wildlife Toxicology and Population Modeling*. CRC Press, Boca Raton, FL. 576 p.

Maughan, J. T. 1993. *Ecological Assessment of Hazardous Waste Sites*. Van Nostrand Reinhold, NY. 352 pp.

Newman, M. C. 1994. *Quantitative Methods in Aquatic Ecotoxicology*. CRC Press, Lewis Publishers, Boca Raton, FL.

Suter, G. W., Barnhouse, L. W., Bartell, S. M., Mill, T., Mackay, D., and Patterson, S. 1993. *Ecological Risk Assessment*. Lewis Publishers, Boca Raton, FL. 560 pp.

## B.7 Electronic Resources

Keeping informed and being able to access current information resources is becoming increasingly important in many fields including ecological risk assessment. State and Federal agencies (EPA, USFWS, DOE) and universities are providing increasing amounts of information on the Internet relevant to the conduct of ERAS. Regulatory agency news (EPA, USFWS, DoD, DOE, USACE), new guidance, government documents, university libraries and herbaria, and natural history museums are all accessible via the Internet. Updated endangered and threatened plant and animal lists, habitat information, on-line herbaria and museums, plant images, state biota collecting regulations can be readily consulted for information applicable to site-specific ecological risk assessments. Ecotoxicological contaminant information will also be available on the Internet in the near future. The following is a small sampling of relevant agencies and databases accessible on the Internet:

### AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR):

*Internet Address:*

<http://atsdrl.atsdr.cdc.gov:8080/atsdrhome.html>

Provides access to on-line databases such as *HazDat*, *ToxFAQs* and ATSDR's toxicological profiles.

### ENVIRONMENT CANADA

*Internet Address:* <http://www.doe.calenvhome>

Environment Canada provides a Green Lane (environmental information domain within the www) for interactive access to Environment Canada Services, products, information holdings, programs, regulations, and policies.

### NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

*Internet Address:* <http://www.noaa.gov>

NOAA's Coastal Resource Coordinators (CRC) are based in Seattle, WA. CRC is a branch of NOAA's Hazard Materials and Response (HAZMAT) Division, which is a major unit in NOAA's Office of Ocean Resources Conservation and Assessment (ORCA). ORCA is one of four major line organizations of the National Ocean Service, within NOAA (U.S. Dept. of Commerce). ORCA's three other units (based in Silver Spring, MD) include: (1) the

Coastal Monitoring and Bioeffects Assessments Division (CMBAD) which includes the *National Status and Trends (NS&T) Program* (Mussel Watch Project, Benthic Surveillance Project, Bioeffects Surveys, Specimen Banking, and Coastal Contamination Assessments), (2) the Damage Assessment Center (DAC) which provides scientific and economic expertise as one component of NOAA's Damage Assessment and Restoration Program (DARP) and recovers funds for restoration of NOAA trust resources, and (3) the Strategic Environmental Assessments (SEA) Division which conducts a comprehensive national assessment program focusing on the characterization of coastal and ocean resources (includes the GeoCOAST, geographic information systems facility).

#### U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTATIVE MEDICINE (USACHPPM)

*Internet Address:* <http://chppm-www.apgea.army.mil>  
Provides access to USACHPPM's Entomological Sciences Program, Hazardous and Medical Waste Program, the Health Hazard Assessment Program, as well as other remote environmental-military www servers.

#### U.S. ARMY CORPS OF ENGINEERS

*Internet Address:* <http://www.cecer.army.mil:80/welcome>.  
Construction Engineering Research Laboratories (USACERL) and Defense Environmental Network and Information Exchange (DENIX) USACERL developed the Defense Environmental Network and Information Exchange (DENIX), an electronic bulletin board accessible throughout DOD. DENIX is the fast DECIM migration system to be fielded. It is based on the Army's Defense Environmental Electronic Bulletin Board System, which was also developed at USACERL. DENIX went online in August 1993. This bulletin board allows users to: (1) read online environmental publications (proprietary or DOD-specific); (2) send and receive mail electronically on the DENIX host computer or across the Internet; (3) exchange environmental information via managed discussion forums based on a subject area; (4) send and receive required reporting data through the chain of command; (5) peruse and request environmental training courses and seminars; (6) access the DENIX directory service database; and (7) upload and download files from DENIX to and from a personal computer. DENIX provides DOD environmental managers with a central communications platform from which to obtain timely access to environmental legislative, compliance, restoration, cleanup, and DOD unique information.

USACERL Points of Contact (POCs) are Mr. Calvin Corbin, COMM 217-373-6731, and Mr. Steve Luzzi, COMM 217-352-6511, ext. 446. Both can be reached toll-free at 800-USA-CERL, ATTN: CECER-ECD, P.O. Box 9005 Champaign, IL 61826-9005.

#### U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

*Internet Address:* [www.epa.gov](http://www.epa.gov)

EPA's WWW server provides access to a number of on-line resources including policy documents, regulations, software, and databases. Most regions currently have Public Access Information servers accessible through the main web homepage.

#### Multimedia Exposure and Ecological Risk Assessment

[ftp://ftp.epa.gov/epa-ceam/wwwhtml/ceam\\_software\\_products.html](ftp://ftp.epa.gov/epa-ceam/wwwhtml/ceam_software_products.html)

The Center for Exposure Assessment Modeling provides current multimedia exposure and ecological risk assessment software programs such as Qual2eu,, Fgets, Multimed, Plumes, Minteq, Femwater, and Przm2.

#### EPA Online Library System

Telnet\_ [epaibm.rtpnc.epa.gov](http://epaibm.rtpnc.epa.gov), select public access applications menu; EPA National Online Library System.

Extensive databases of EPA document holdings and EPA's endangered species database.

#### National Listing of Fish Consumption Advisories (NLFCA)

*Internet Address:* [www.epa.gov/OWOW/fishadvice](http://www.epa.gov/OWOW/fishadvice)  
Database includes all available information (including maps) describing State-issued fish consumption advisories in the U.S. Fish consumption advisories, issued when mean mercury concentrations exceed the FDA limit of 1.0 ppm (0.5 ppm in Florida) have been issued for 10 states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana- Mississippi, North Carolina, South Carolina, and Tennessee. For further information, contact Jeffrey Bigler, EPA, at 202-260-1305 (fax: 260-9830).

Field and Laboratory Test Methods and Procedures  
WAIS \_ [waiss.epa.gov](http://waiss.epa.gov), database/indexes/ALL, port 210

Field method guides, field operation manuals, laboratory test manuals, quality assurance plans, laboratory method manuals, test procedures, and more.

#### U.S. FISH AND WILDLIFE SERVICE

*Internet Address:* <http://www.fws.gov>

Provides lists of current and proposed listed (and delisted) Endangered and Threatened Wildlife and Plants for each state or territory.

#### U.S. FOOD AND DRUG ADMINISTRATION (FDA)

*Internet Address:* [www.fda.gov](http://www.fda.gov)

FDA provides information on state fish and snapping turtle advisories. Although this information is provided for human health reasons, it can be used for identifying regional anthropogenic contaminant sources. FDA levels in fish and seafood are for interstate commerce.

#### U.S. GEOLOGICAL SURVEY (USGS)

*Internet Address:* <http://www.usgs.gov>

Various databases are available

#### ALSO SEE:

#### FEDWORLD INFORMATION NETWORK:

*Internet Address:* Telnet - [fedworld.gov](telnet://fedworld.gov)

Provides internet gateway to wide range of U.S. government bulletin board systems, such as

EPA Bulletin Boards

Telnet - [fedworld.gov](telnet://fedworld.gov)

Access to NOAA, DOI's Office of Environmental Affairs BBS, Clean-Up Information BBS (Superfund Data and other hazardous waste information).

Ohio Environmental Protection Agency

WWW URL - <http://arcboy.epa.ohio.gov/oepa.html>

Environmental Resource Gophers:

[epa.gov](http://epa.gov)

[riceinfo.rice.edu](http://riceinfo.rice.edu)

[gamet.berkeley.edu](http://gamet.berkeley.edu) 1250

[utdallas.edu](http://utdallas.edu)

[ecosys.drdr.virginia.edu](http://ecosys.drdr.virginia.edu)

#### STATE ENVIRONMENTAL AGENCIES:

Most of the State environmental agencies are now on Internet, including:

Washington Dept. of Ecology

California Environmental Resource Evaluation System (CERES)

Oregon Online

Idaho Dept. of Water Resources

Montana Natural Resources Information

Pennsylvania Dept. of Environmental Resources

#### DIALOG DATABASES (Telnet):

Cambridge Scientific Abstracts: Now available on Internet at [www.csa.com](http://www.csa.com).

Enviroline: Provides indexing and abstracting coverage of more than 5000 international primary and secondary source publications reporting on all aspects of the environment.

Environmental Bibliography: Covers the fields of general human ecology, atmospheric studies, energy, land resources, water resources, nutrition, and health.

Pollution Abstracts: Leading resource for references to environment-related literature on pollution, its sources, and its control.

#### MAJOR EPA ENVIRONMENTAL DATABASES (Telnet):

TOXNET: Toxicology Data Network (Medlars) available through National Library of Medicine (NLM) and EPA's National Computer Center (EPA/NCC); accesses: Integrated Risk Information System (IRIS)  
Hazardous Substances Data Bank (HSDB)  
Registry of Toxic Effects of Chemical Substances (RTECS) (also on CIS)

AQUIRE: Aquatic Information Retrieval System (available through CIS)

ASTER: Integration of the AQUIRE and QSAR systems

PHYTOTOX: Biological effects of application of organic chemicals to plants (available through CIS)

ECOTOX: Combined databases for terrestrial and aquatic organisms, including ASTER, AQUIRE, PHYTOTOX, and TERRETOX